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Full Representation

On learning that iron, steel, heavy non-ferrous and aluminium founders, through their established organisations, had met and decided to create a permanent committee, our mind went back to 1924, when we wrote a leading article on a "Commercially-voiceless Industry." To-day we should probably use the expression "inarticulate"; however, the earlier phrase stresses the major need, for since 1904 the industry was capable of voicing its technical requirements. With the passage of time the need for one voice for the industry has become more pressing owing to the acceleration of industrial legislation. Some of this comes about so quickly that there is scarcely time to consider the major implications of a measure before it is the law of the land. Thus there is, to-day, an urgent need to act quickly, and the creation of a liaison committee representing such a vast industry gives some sort of assurance that legislation containing clauses adverse to the interests of founding will be the subject of a protest carrying a maximum weight of authority.

In these times of excessive committee work, there appears to be, by the formation of a liaison authority, a chance of the reduction of much work. Take for instance but two subjects—conditions of sale and costing. Herein several associations have given prolonged thought to the subjects and have produced recommendations. By the interchange of the knowledge and experience gained, much spade work can be eliminated. The financing of such organisations is another subject upon which an interchange of information could usefully be effected. So far as we can see, there are but few activities undertaken by the employers' federations which will not benefit materially through co-operation.

The action which has been taken places this country in the same category as France and the United States. In France, the *Syndicat des Fondeurs* has been long established and now possesses its own imposing buildings. In the States it is only recently that the first meeting of all founding industries was held. The creation of the liaison committee must meet with universal approbation, as no section of the community can possibly charge it with having selfish motives. Its coverage is far too wide to represent anything other than the interests of the whole of the foundry industry. It should, of course, be borne in mind that none of the associations represented has anything to do with wage policies. The major activity of all of them is to ensure that the sections they represent conduct their affairs on a proper businesslike basis and to see that they are not imposed upon by other interests. Wisdom has been shown in choosing Mr. P. H. Wilson, O.B.E., as independent chairman. As the President of the Institute of British Foundrymen, he is equally interested in the welfare of all sections.. Moreover, technology and business to-day are interconnected through the growing tendency to standardise the products of the industry. Standard specifications are the joint output of the technical and commercial interests of the supporting industry and its customers. Our readers will join us in wishing the new committee success in its endeavours and, if the future gives them but little work to do, so much the better. Yet, unfortunately, we fear the reverse will be the case.

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Forthcoming Events

(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)

JANUARY 24.

Institute of British Foundrymen.

East Midlands Branch :—"The Constant Charge System of Cupola Operation," by W. W. Braidwood, at Loughborough College, at 6 p.m.

JANUARY 28.

London Branch :—"Precision Casting of High Melting Point Alloys containing Nickel." Paper and technicolour film by H. Evans, P. S. Cotton, and J. Thexton, at the Waldorf Hotel, Aldwych, London, W.C.2, at 7.30 p.m.

The Institute of Vitreous Enamellers.

Southern Section :—Annual General Meeting at the Charing Cross Hotel, London, W.C.2, at 6.30 p.m., followed by a Paper entitled "Bubbles" (winning entry for Whittle Competition), by J. A. Clarke, B.Sc.

JANUARY 31.

Institute of British Foundrymen.

Wales and Monmouth Branch :—"The Development of Foundry Sand Control," by G. L. Harbach, at the Engineers' Institute, Cardiff, at 6.30 p.m.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

CONVERTER PRACTICE

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—Mr. Robert C. Fairall, of Victoria, B.C., in his letter to you, dated November 9, writes:—

"Could more information be given on spectroscopic control of the converter flame? I first read of this in 'Spectroscopy' by Huggins, printed around 1880. Apparently Bessemer must have tried it!"

Spectroscopic control of the Bessemer converter flame certainly was tried before the publication of "Spectroscopy" by Huggins in 1880.

I enclose photostatic copies of pages 200, 201, 202 and 203 of a book entitled "Iron" by William Fairbairn, C.E., LL.D., F.R.S., F.G.S., corresponding member of the National Institute of France and of the Royal Academy of Turin, Chevalier of the Legion of Honour, etc., which was published by Adam & Charles Black, of Edinburgh, in 1865. It will be noted that Roscoe was responsible for the introduction of spectroscopic control of the Bessemer flame more than 80 years ago, at the Sheffield works of John Brown & Company.

There seems to have been a gap of something over 80 years before further serious work was done. A Paper was published by the Iron and Steel Institute in 1945, written by S. T. Jazwinski, as a result of his research into the subject at K. & L. (Steelfounders & Engineers), Limited, at Letchworth, Herts.—Yours, etc.,

FELIX LEVY,
Director.

George Cohen, Sons & Company, Limited,
Broadway Chambers,
Hammersmith, London, W.6.
January 5, 1948.

[*From the photostats, we have extracted the paragraph dealing with the earliest use of the spectroscope in converter practice.*—EDITOR.]

"At the request of Messrs. John Brown & Company, of the Atlas Works, Sheffield, Mr. Roscoe investigated the subject, and succeeded in obtaining very satisfactory and interesting results. The instrument employed was an ordinary Steinheil's spectroscope, furnished with photographic scale and lamp, and provided with a convenient arrangement for directing the tube carrying the slit towards any wished-for part of the flame, and for clamping the whole instrument in the required position. By help of such an arrangement the spectrum of the flame can be most readily observed and the changes which periodically take place can be most accurately noted.

"The light which is given off by the flame in this process is most intense; indeed, a more magnificent example of combustion in oxygen cannot be imagined; and a cursory examination of the flame spectrum in its various phases reveals complicated masses of dark absorption bands and bright lines, showing that a variety of substances are present in the flame in the state of incandescent gas. By a simultaneous comparison of these lines in the flame spectrum with the well-known spectra of certain elementary bodies, the presence of the following substances in the Bessemer flame, *viz.*, sodium, potassium, lithium, iron, carbon, phosphorus, hydrogen and nitrogen, was detected.

"A further investigation, with an instrument of higher dispersive and magnifying powers than that employed, will doubtless add to the above list; and an accurate and prolonged study of this spectrum will probably yield very important information respecting the nature of the reactions occurring within the vessel. Already the investigation is so far advanced that the point in the condition of the metal at which it has been found necessary to stop the blast can be ascertained with precision; and thus, by the application of spectrum analysis, that which previously depended on the quickness of vision of a skilled eye has become a matter of exact scientific observation."

WE ARE ADVISED that difficulty arising from the shortage of supply of soap for automatic industrial clothes washing machines can be overcome by using a substitute called Wulpax, made by Fetchetts, Limited, 20-30, Abbey Street, Hockley, Birmingham, 18.

SHOT-PEENING OF non-ferrous has experimentally increased the resistance to stress and corrosion, especially in the case of brass, aluminium and magnesium. In some cases an increase in life of the order of 40 times is given, according to a writer in "Materials and Methods."

THE EYRE SMELTING COMPANY, LIMITED, of Tandem Works, Merton Abbey, S.W.19, have combined a wall calendar with a chart listing the sizes and weights of chill-cast phosphor-bronze rods which they manufacture. This is available to our readers on writing to Merton Abbey.

Methods of Testing Metallic Abrasives*

By J. E. Hurst, D.Met., J.P.

Applications for Metallic Abrasives

Metallic abrasives are used extensively in all the various forms of machinery for the cleaning and treatment of the surfaces of various articles by blasting processes. They are manufactured in two forms and frequently spoken of as chilled shot and grit respectively. By metallic shot is understood the rounded, more or less spherical particles of metallic material in contradistinction to the angular or cornered particles possessing a multiplicity of cutting edges. This latter form is referred to as metallic grit or cornered grit. Apart from their use in shot blasting machinery or mechanically operated machines of the Wheelabrator type for various cleaning operations, metallic abrasives of this type find a use in a variety of special applications, as for example, stone sawing, cutting and polishing, well boring and drilling, and the development of special surface finishes on articles of various descriptions in a variety of materials in addition to metals. Such abrasives, for example, have been used for the preparation of surfaces on woods and bricks.

An important special application of the shot blasting treatment has been developed over the last few years in the surface treatment of springs particularly, and other parts highly stressed in service, with the object of improving their resistance to fatigue failure. It is well known that the initiation of fracture in fatigue failures is conditioned to a considerable extent by the character of and the stress conditions in the surface of the particular part. The peening action on the surface arising during shot blasting in many instances has been found to have a profound effect in bringing about surface conditions highly resistant to fatigue failure.

Each and every one of these operations enumerated are operations of considerable importance in the engineering and metallurgical industries. In a like manner the metallurgical character and the properties of metallic abrasives, shot and grit, are matters of equal importance, and their study and the establishment of methods of examination and testing is fundamental to the maintenance and improvement of the efficiency of this material in its various uses.

Grading the Shot

For these many purposes both shot and grit are manufactured and supplied in a range of sizes from finely crushed material of less than 100 mesh up to comparatively coarse grades. It is found in practice that different grades or sizes are suitable for different classes of work and the production of different types of surface finish.

The requirements of shot and grit may reasonably be expected to differ according to the particular purpose for which they are used. For example, it may be expected that the operations of stone sawing and cutting will demand characteristics in the abrasives different from those required for the operations in the surface preparation of castings and sheets for vitreous enamelling. Whatever the service, however, the performance of abrasives in service is estimated in terms of the character and quality of the work done and their length of life. The former is fundamentally difficult to express in numerical terms in any individual case, and is commonly an expression of opinion on the part of the operators and managements, reinforced of course by their knowledge and experience of their particular requirements and often by comparative methods based on work done with standards known to be acceptable. The length of life of abrasives can be expressed in a variety of ways, and the one which has an obvious appeal is the amount of abrasive used in relation to the quantity of articles treated.

Service Tests

Whilst it cannot be gainsaid that the final test of the quality of metallic abrasives, whether shot or grit, lies in their actual behaviour in service, it is equally true to say that service tests are not always easy to carry out, and it is generally difficult to obtain convincing and conclusive results from such tests. In service, apart from the abrasive itself, there are a large number of factors which have an influence on performance. The design and type of the blasting machine, the technique of the machine operation and such considerations as air pressure and velocity in mechanical machines, nozzle type, shape and condition, angle of impingement and distance of the shot stream from the work are amongst the factors which have been shown to be important.[1] In individual cases by careful control, such service tests can be made to provide important information and comparative results of value.[2] Perhaps the greatest single difficulty associated with service tests arises from the fact that such tests are almost always of comparatively long duration. On all these grounds alternative methods of testing, particularly laboratory tests, become matters of considerable importance.

Metallurgical knowledge reveals that the properties of hardness, strength, toughness and, in fact, all the physical and mechanical properties of metals are capable of substantial variation according to the chemical composition and the thermal treatment to which the metal has been subjected during manufacture, and it would not be unexpected to find that metallic abrasives under any given conditions of service could reveal differences in service behaviour bearing some relationship to their physical and mechanical properties, resulting from their chemical composition and thermal treatment in manufacture.

*A Paper presented to the Annual Meeting of the Institute of Vitreous Enamellers.

Methods of Testing Metallic Abrasives

FIG. 1.—MICRO-STRUCTURE OF DRASTICALLY CHILLED ABRASIVE. × 120, ETCHED.

Chilled Shot and Grit and its Constitution

Modern metallic abrasives are manufactured from chilled iron with carbon contents which may lie within the range 2.75 to 3.5 per cent. In all the existing processes the iron used is chilled by processes in which the molten metal is granulated or disintegrated in small drops or fine globules which are immediately quenched in water. To a large extent due to smallness in size of the particles of molten iron as quenched, the nature of this chilling operation may be very severe. The severity of the chilling or quenching of individual particles, in addition to depending upon their size, depends also upon the temperature of the molten metal from which they are quenched, and the effectiveness of the quench, *e.g.*, the quickness with which they are immersed and the nature of the quenching medium. The conditions of molten metal temperature, the speed of quenching and the nature of the quenching medium may vary as and between one process of manufacture and another, with the consequent effect of variation in the severity of the chilling operation. This in turn affects the constitution of the shot or grit as revealed by the micro-structure. For this reason the examination of the structural character is regarded as of considerable importance in the methods of testing metal abrasives.

Under conditions of very drastic chilling very fine grained structures are generally obtained, and on examination of polished and etched sections under the microscope high degrees of magnification are necessary in general completely to resolve the structure. The structure of drastically chilled material etched with Nital or picric acid shows a mass of hard carbide and phosphide (white etching constituents), embedded in a dark etching ground mass essentially martensitic in character, together with some austenite. Typical examples are shown in Figs. 1 and 2, which show, respectively, a specimen at a magnification of 120 and 1,200 diameters

The structure of the ground mass is very frequently a guide as to the severity of the quenching, and incidentally the hardness and toughness. With less severe quenching the presence of austenite and martensite diminishes in the structure, which tends to become more pearlitic in character.

Irregularity of size of the granulated material during quenching is responsible for variation in character of the structure observed in examining individual grains of abrasive. This is revealed generally by the extent of the martensitic character which is affected by the quenching conditions and the tendency to greater or lesser amount of austenite. The presence of small amounts of such elements as nickel, copper, chromium, molybdenum, etc., occurs very frequently in the materials used in the present-day manufacture of abrasives, and according to their nature and amount they can exert quite a marked influence on the tendency towards martensitic or austenitic characteristics under the drastic quenching conditions.

The total amounts of such residual elements to-day may quite easily exceed 0.5 per cent. and amounts in excess of 1.0 per cent. are by no means uncommon.

With the knowledge of the effect of low temperature heat-treatment on material of this character in developing maximum hardness and strength conditions, certain manufacturers have adopted heat-treatment in the process of manufacture. Apart from its effect on hardness and strength, heat-treatment also tends to improve considerably the uniformity of the structure of the abrasive, a factor which makes for improved behaviour in service. Marked variation in structural character of individual grains of abrasive may be taken as an indication of the absence of heat-treatment during manufacture.

The procedure followed in the preparation of specimens for micro-examination is straightforward, in that a number of grains are embedded in bakelite and polished suitably for etching and examination in the usual way.

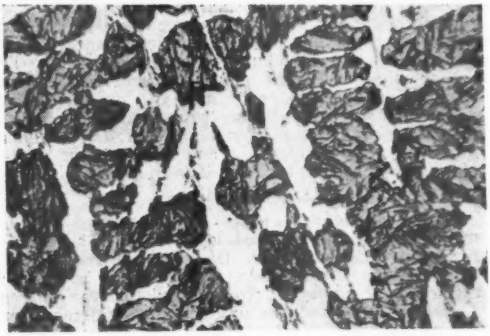

FIG. 2.—MICRO-STRUCTURE OF DRASTICALLY CHILLED ABRASIVE. × 1,200, ETCHED.

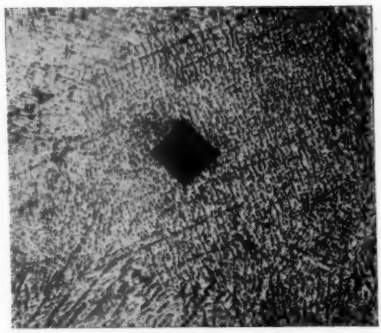

FIG. 3.—DIAMOND HARDNESS IMPRESSION IN SPECIMEN OF ABRASIVE (ENLARGED).

Hardness

The hardness of actual grains of abrasive, either shot or grit, can be measured best by diamond hardness testing, using either the Firth, Vickers or Rockwell hardness-testing machines. In the Firth or Vickers machines quite low indenting loads can be applied, thus avoiding the fracture of individual grains. Specimens can be mounted in white metal or Bakelite and ground and polished to provide flat surfaces suitable for hardness testing. A typical test specimen showing a magnified view of the diamond hardness impression is shown in Fig. 3. The hardness test can prove to be useful in evaluating the quality of metallic abrasives. Uniformity of hardness value in a number of individual particles from any one sample is an excellent indication of care in manufacture and the possibility of treatment having been applied to secure uniformity.

A few results extracted from various investigations in the Bradley and Foster laboratories are assembled in Table I. The mean hardness values recorded in this table are those determined in the complete investigation and are not necessarily the mean of the seven determinations shown in the Table. These determinations are examples of the type of hardness variation encountered in individual samples. Samples having a mean hardness of over 750 are found to contain particles substantially lower, as, for example, the grit sample 46/1 with a low figure of 464. The table also includes a sample showing a low mean hardness of 600. In comparison with these figures the mean hardness of grit manufactured by the company with which the author is associated lay between the values of 844 and 920 for the period June, 1945, to August, 1946.

In Table II is a selection of mean hardness determinations of samples of the products of British and foreign firms over the last 10 years. Hardness values of over 1,000 are recorded, and in general it will be seen that the values can be regarded as in excess of a round figure of 850.

Specific Gravity and Density Determinations

The determination of the specific gravity can be carried out conveniently by the density bottle method, and in many investigations can prove to be of value. In the case of shot in particular, it may prove a useful guide as to the extent of unsoundness. It does happen in hardness determinations on shot samples that low results are obtained due to the existence of unsoundness cavities in the centre of each grain. Apart from the existence of porosity a higher specific gravity indicates a proportionately higher energy content of moving particles of abrasive of identical size at the same velocity. In a series of determinations from the Author's laboratories, previously published,[3] values of 7.40 to 7.53 were reported in samples from various sources showing a difference of 2 per cent. approximately from the lowest to the highest result. The further values recorded in Table III show some results lower than these, figures of 7.26 approximately being recorded. In both these cases the presence of unsoundness was detected on examination under the microscope, and it is quite likely that, in either grit or shot of normal manufacture, values of this low order are indicative of unsoundness.

There are two other density determinations which may provide useful information in the case of investigation. They are, respectively, the bulk density or packed density, and the loose packing density or loading weight. A simple method of making bulk density determinations can be carried out by the use of a graduated glass tube closed at one end into which samples of shot or grit can be poured. This tube containing the sample is tapped longitudinally until the grit settles to a level which remains constant even after further tapping. The volume of the packed sample is measured, and, knowing the initial weight, the bulk density in grams per cubic centimetre can be calculated.

TABLE II.—*Mean Vickers Hardness No. of Various Shot and Grit Samples.*

No.	Type.	Source.	Mean Vickers Hardness No.
G.H.	Grit ..	British, 1945 ..	920
S.A.	Shot ..	British, 1936 ..	1,016
S.C.	Shot ..	British	999
S.D.	Shot ..	German	912
G.F.	Grit ..	German	1,048
S.E.	Shot ..	American	905
G.G.	Grit ..	American	920
G.B.	Grit ..	American	883

TABLE I.—*Vickers Diamond Hardness Determinations on Shot and Grit Samples.*

No.	Type.	Determinations.							Mean.	Source.
47/1	Shot	847	824	824	824	724	665	564	753	European
47/1	Grit	858	858	821	803	803	715	404	760	European
47/6	Grit	828	824	803	780	780	700	640	771	European
—	Shot	645	642	642	642	606	545	514	600	South Amer

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TABLE III.—*Mean Specific Gravity of Various Shot and Grit Samples.*

No.	Type.	Source.	Mean specific gravity.	Bulk density, gms. per c.c.	Loose packing density, gms. per c.c.
G.H.	Grit ..	British, 1945	7.493	4.20	3.74
S.A.	Shot ..	British, 1936	7.500	4.14	4.03
S.C.	Shot ..	British ..	7.455	4.10	3.80
S.D.	Shot ..	German ..	7.450	4.30	3.88
G.F.	Grit ..	German ..	7.262	4.50	3.90
S.E.	Shot ..	American ..	7.330	4.18	3.88
G.G.	Grit ..	American ..	7.413	4.30	3.95
G.B.	Grit ..	American ..	7.265	4.57	3.88

In the author's laboratory a graduated tube two metres long and one centimetre diameter is used with a sample of an average weight of 350 grammes.

The loose packing density is determined by allowing the shot or grit to flow freely from a smooth funnel at a fixed height over a container of known volumetric capacity. The surplus over that required to fill the container is skimmed off by drawing a knife carefully over the top of the container. The weight of grit which completely fills the known volume of the container expressed in grammes per cubic centimetre is the loose packing density or loading weight.

Particle Shape

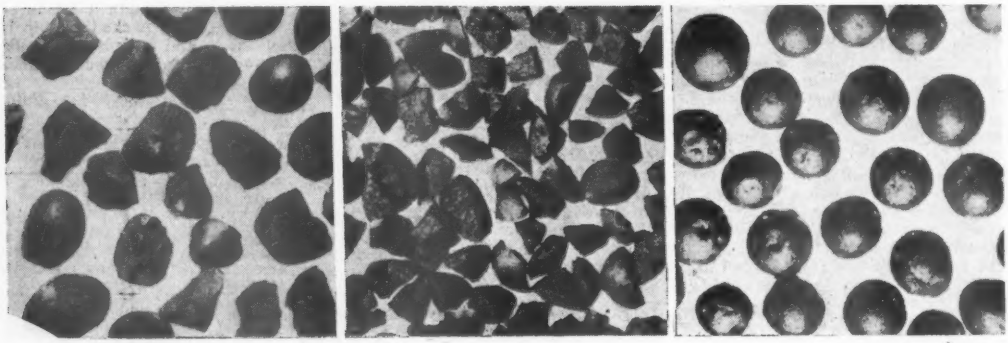
An important factor in the behaviour of abrasives in service, particularly in the case of angular material or grit, is the particle shape. Considerable thought and investigation has been devoted to the question of the appraisal of shape factor of irregularly shaped particles of all kinds of material, and there are quite a number of experimental methods devised for the determination of data which will allow of some aspect of this shape factor being expressed numerically. A difference in shape of particles would be expected to lead to a difference in packing characteristics, and hence it may be expected that these packing density figures may be helpful in this direction.

The values given in Table III for the density determinations are typical of those obtained with shot and grit of normal production. It is of special interest to examine the figures for the two samples "SA" and "SC." Whilst the bulk density values are nearly identical, the loose packing density figures are sizeably different. These two samples are of different manufacture, but very closely alike in size and revealed by sieve test, being 29.8 per cent. and 24.8 per cent. through 7 and retained on 9 mesh respectively, and 70.2 per cent. and 75.2 per cent. retained on 7 mesh. The marked difference in loose packing density is an indication of difference in shape factor of these two samples.

Examination of Shape

The shape of particles may be studied better by individual examination under the binocular microscope than by direct magnification with a single tube microscope. It is a matter of some difficulty to record photographically with complete satisfaction the angularity of grit, owing to the difficulty of conveying an accurate rendering of the impression of depth. Fig. 4 (*a*), (*b*), and (*c*) show some of the characteristics of the specimens referred to in Table III. These illustrations serve as examples of the type of photographic record of shape obtainable and their value in the critical examination of this material. The uniform particle shape of "G.G." Fig. 4 (*b*) is quite noticeable. The photograph of the shot "S.D." Fig. 4(*c*) reveals sinking characteristics in the individual particles.

A common method of detecting the presence of shot in admixture with grit is the use of an inclined plane. A quantity of grit is placed on a smooth board, which is raised gradually from a horizontal position until an



(*a*) (*b*) (*c*)

FIG. 4.—PARTICLE SHAPE OF METALLIC ABRASIVES.

angle is attained at which the rounded particles tend to flow down the inclined plane.

Strength Properties

It is difficult to conceive of a method for the direct determination of the simple strength properties of material in the form of abrasives, whether angular or round. The strength properties likely to be of interest are the ultimate breaking strength, the resilience value, and perhaps the modulus of elasticity. These properties are of interest in so far as they can throw light on the resistance to disintegration of abrasive under the various service conditions under which it is called upon to operate. Whilst investigational work can be done and, in fact, has been done in the author's laboratories, on this material in sizes suitable for the provision of test pieces for use in various types of testing machines, it is by no means certain that such work gives a true indication of the properties of this same material after undergoing the treatments involved in the manufacture of abrasives.

As a control test in manufacture it has been common practice to make a somewhat arbitrary determination of the crushing strength. In general the method followed has been to select a suitable size of spherical particle and determine the load required to crush the particle. In practice an individual manufacturer has been able to draw up a list of crushing loads for different sizes of shot to use as a standard of reference. Another method designed to appreciate the toughness of the material takes the form of a drop test or impact test in which a known weight is dropped on to individual specimens of shot of known diameter. In this method the height required for this known weight to fall to fracture the shot in a single blow is finally arrived at and used as a comparative measure of the toughness of the shot.

Toughness and Crushing Index

This impact method of testing has been expanded in the author's laboratory to provide a crushing index which shall be applicable to irregular particles as in the case of grit. It is very desirable to be able to express "quality" of a grit mathematically in terms readily comparable and easily determined by a laboratory test. The crushing index test described as follows is put forward as a type of "toughness" test, the results of which can be expressed by a number.

The idea was originally based upon the well-known shatter index determination, as applied to furnace cokes. The metallic abrasive is graded on standard sieves before and after being subjected to a standard crushing treatment. The change in particle size during the test is taken as a measure of that property of grit which is familiarly called "the toughness."

The apparatus shown in Fig. 5 consists of a small hardened steel mortar with a central hole 1½ in. deep, and of diameter sufficient to take a sliding hardened steel pestle 1¼ in. dia. by 2 in. long. This assembly is mounted between vertical parallel bars on a firm metal base. A weight of 4 lb. secured by a movable hook 14 in. above the head of the pestle can, when required, be allowed to slide relatively unimpeded down the parallel bars to give an impact on the pestle. The weight can be pushed back by hand and re-secured by the hook prior to a second descent.

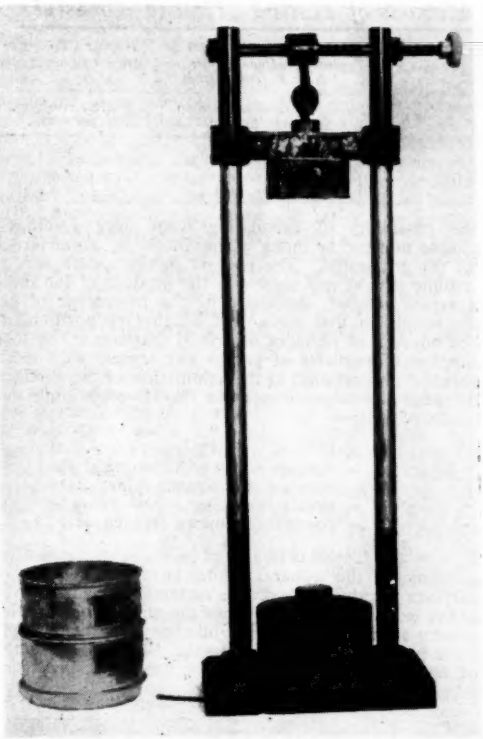


FIG. 5.—APPARATUS FOR DETERMINING CRUSHING INDEX FOR ABRASIVE.

A graded sample of 10 grms. of grit is taken for this test, and approximately one-third is spread in the bottom of the mortar underneath the pestle. The weight is allowed to descend and make an impact on to the pestle head in all ten times per each batch of grit. The crushed grit is removed from the mortar and, when the remainder of the sample has been similarly treated, the whole is re-graded in standard sieves. The figures obtained during the initial and final gradings are used for the calculation of the "crushing index of the grit."

Notes on the Evaluation of a "Crushing Index"

A typical result of standard sieve gradings before and after crushing in the test apparatus is given in Table IV. The evidence of crushing from the table is difficult to interpret quantitatively, and some thought was given to

Methods of Testing Metallic Abrasives

TABLE IV.—*Typical Gradings Before and After Crushing. B. & F. Grit. Grade "D."*

Sieve sizes.	Before crushing, per cent.	After crushing, per cent.
+ 18	9.0	4.0
+ 28	88.0	78.0
+ 60	3.0	12.0
+150	Nil	6.0

the possibility of calculating from sieve gradings a simple number or index which would be characteristic of the grit tested. The method finally chosen was to assume that at any sieve size the product of the mesh aperture number, multiplied by the percentage of grit remaining on that sieve, was roughly proportional to the number of particles of grit of that size. The total number of particles of grit in any sample will, therefore, be proportional to the summation of the products of mesh size × percentage for the sieve covering that grade of grit:—

$$i.e., N = \Sigma \cdot K (S_1 P_1 + S_2 P_2 + \ldots\ldots S_n P_n)$$

Where N = number of grit particles in sample.
K = constant of unknown value.
S = sieve size number.
P = percentage retained on each sieve.

If, now, the sample is re-graded on the same sieves after crushing in the apparatus, the increased number of particles produced may be determined again by the above expression. The ratio of the number of particles present after crushing to the number of particles originally present is then related to the "toughness" factor of the grit, and may be called a "crushing index."

$$i.e., CI = \frac{N_f}{N_o} = K \frac{\Sigma S_n P_f}{\Sigma S_n P_o}$$

where CI = "Crushing Index."
S_n = Sieve size.
P_o = Original percentage on each sieve.
P_f = Final percentage, after crushing, on each sieve.
N_o = Number of particles of grit in original sample.
N_f = Number of particles of grit after crushing.

As an example of the way in which the "crushing index" of a grit may be determined, the method of working is shown in Table V, using the "D" grade grit. grading figures in Table IV. (N.B.—The constant K is assumed to be constant for the apparatus and method of working, and may be neglected.) A number of check determinations of CI for the same sample of "D" grade grit gave values ranging from 1.34 to 1.37.

Variations in "Crushing Index" with Grit-size Variations."—The "crushing indices" of Bradley & Foster grit, Grades A to F, were determined. The value for the "index" was found to depend upon the initial grade, *i.e.*, Grade "A" gave 1.64 and Grade "F" gave a

TABLE V.—*The Determination of "Crushing Index."*

Sn.	Po.	Pf.	SnPo.	SnPf.
18	9.0	4.0	162	72
28	28.0	78.0	2,464	1,284
60	3.0	12.0	180	720
150	Nil	6.0	—	900
			Σ SnPo2,806	Σ SnPf3876.

$$CI = K \frac{\Sigma S_n\ Pf}{\Sigma S_n\ Po} = K \frac{3,876}{2,806} = 1.38.$$

TABLE VI.—*Comparison: Potter & Soar Standard-v-B.S.I.-v-I.M.M. Sieves.*

Mesh.	S.W.G.			Aperture.			Screening Area, per cent.		
	Potter & Soar.	B.S.I.	I.M.M.	Potter & Soar.	B.S.I.	I.M.M.	Potter & Soar.	B.S.I.	I.M.M.
4	19	None	None	0.210	None	None	71	None	None
5	20	15½	12	0.164	0.132 1/8	0.100	67	44	25·0
6	21	17	None	0.135	0.1107 3/32	None	65	44	None
7	22	18	None	0.115	0.949 1/10	None	65	44	None
8	23	18½	16	0.101	0.0810 5/64	0.062	65	42	24·6
9	24	None	None	0.089	None	None	64	None	None
10	25	20½	18	0.080	0.0660 1/16	0.05	61	44	25·0
12	26	22	19	0.065	0.0553 1/18	0.0416	58	44	24·92
14	27	23	None	0.055	0.0474 3/64	None	56	44	None
16	27	23½	21	0.0461	0.0395 1/25	0.0312	54	40	24.92
18	28	24	None	0.0408	0.0336 1/30	None	54	36	None
20	28	None	23	0.0352	None	0.025	50	None	25.0
22	29	26	None	0.0319	0.0275 1/36	None	49	36	None
24	29	None	None	0.0281	None	None	45	None	None
25	None	27	None	None	0.0236 1/42	None	None	35	None
28	31	None	None	0.0241	None	None	46	None	None
30	32	29	27	0.0225	0.0197 1/50	0.0166	46	35	34.8
36	33	31½	None	0.0178	0.0166 1/60	None	41	36	None
40	34	None	30	0.0158	None	0.0125	40	None	25.0
44	None	34½	None	None	0.0139 1/72	None	None	38	None
50	36	None	33	0.0124	None	0.0100	38	None	25.0
52	None	36	None	None	0.0116 1/84	None	None	37	None
60	37	37	35	0.0099	0.0099 1/100	0.0083	35	35	24.8
72	None	38½	None	None	0.0083 1/120	None	None	36	None
80	39	None	38	0.0073	None	0.0062	34	None	24.6
85	None	40	None	None	0.0070 1/142	None	None	35	None

TABLE VII.—*Grade and Chemical Analysis.*

	A.	B.	C.
Grade Analysis:	Per cent.	Per cent.	Per cent.
Oversize .. .. +28	1.5	2.7	0.5
Size .. −28+60	94.1	88.0	98.0
Undersize .. −60	4.4	9.3	1.5
Dust, oxide and fines −240	0.01	0.26	0.02
	grs./cc.	grs./cc.	grs./cc.
True specific gravity (density)	7.47	7.40	7.44
Bulk density	4.04	4.05	4.06
Loose packing density ..	3.68	3.46	3.90
Graded −28 + 60 loose packing density	3.82	3.44	3.86
Chemical Analysis:	Per cent.	Per cent.	Per cent.
Total carbon	2.95	3.02	2.81
Silicon	1.05	1.49	1.65
Manganese	0.20	0.14	0.36
Sulphur	0.25	0.24	0.21
Phosphorus	1.05	1.49	1.65

figure of 1.03. Intermediate grades gave values which could be plotted in a smooth curve, as shown in Fig. 6. This curve has been called the "characteristic curve" of the particular metallic abrasive being tested.

The Use of the Characteristic Curve.—Check experiments using the standard method and apparatus shown in Fig. 5 confirmed that the characteristic curve could be determined with fair precision for a particular type of metallic abrasive. Once determined, the curve can be used to assess the quality of any other abrasive. It is not necessary for the unknown sample to conform to any one of the standard grades of grit (*i.e.*, "A" to "F"), as any grading can be accommodated by the smooth curve between the standard grades.

The method of working to check up on the quality of a grit is given below:—

(1) The grit is graded on standard sieves (Grades 7, 9, 12, 18, 28, 60, 150 and 200).

(2) The summation of the products of sieve number by percentage retained by each is obtained, *i.e.*, $\Sigma S_n P_o$.

(3) The standard crushing test is carried out and the grit is re-graded to obtain a second summation of products, *i.e.*, $\Sigma S_n P_f$.

(4) The ratio $\Sigma \frac{S_n P_f}{S_n P_o}$ is calculated.

(5) Reading from the "characteristic curve" of the standard range of Bradley & Foster samples, and using the $\Sigma S_n P_o$ values determined in item (2), the derived ratio may be obtained, and the experimentally observed ratio item (5) for the unknown sample may be compared. If in each case the ratio or "crushing index" is the same, then the "toughness" quality of the sample is clearly the same as that of the standard range of grits.

The "characteristic curve" may also be used to assess the quality of other makes of grit, since a higher crushing index for any particular grade (or $\Sigma S_n P_o$ value) would signify a lower toughness. Conversely, a low crushing index denotes superior toughness and absence of particle break-up during test.

Grade Analysis

The examination of both shot and grit for grading is carried out using laboratory sieving machines of the Rotap or Inclyno type equipped with sieves. In this connection it is important to draw attention to the fact that the screening of both shot and grit is carried out utilising the range of mesh sizes of cloth produced by the screen cloth manufacturers. There are important differences between the range of commercially available mesh sizes, and the range of mesh sizes listed in the B.S.I. and I.M.M. standards. It is also important to draw attention to the fact that in any given mesh size of cloth the aperture size is determined by the diameter of the wire used in the cloth, and because of this there are differences in aperture size between the commercial standard cloths of most makers and those listed in the B.S.I. and I.M.M. standards. See Table VI.

In the Author's laboratory it is the practice to equip test sieves with cloth of commercial standard sizes and sizes identical with the cloths actually used for grading purposes. For the determination of dust, oxide and fines, it very often suffices to subject the sample to sieving on a 240-mesh sieve, classifying the material passing through such a fine sieve as dust, oxide and fines. More elaborate methods can be readily devised, including magnetic separation and even chemical analysis, to determine the nature of such material, should be be necessary for any particular investigation.

General Remarks

In describing the methods of testing, it is almost unnecessary to point out their importance in the routine control of the quality of these products during manufacture. It is also intended to show that, with the necessary laboratory facilities, and with a knowledge of the service requirements, laboratory systems of testing can be devised to obtain results which will enable an appraisal of the service behaviour of metallic abrasives to be made. Because of the many factors such as the nature of the plant, the often very intangible character of the requirements and other variants, it is a matter of considerable importance to be able to make exhaustive and strict comparison of the quality factors of the abrasives and to be able to express these in quantitative terms.

TABLE VIII.—*Grade Analysis Before and After Shatter Test.*

		A.	B.	C.
Before ..	Oversize +28 ..	1.5	2.7	0.5
	Size −28 +60	94.1	88.0	98.0
	Undersize −60	4.4	9.3	1.5
After ..	Oversize +28	1.3	1.0	1.0
	Size −28 +60	88.2	76.5	86.3
	Undersize −60	11.5	22.5	12.7
Differences ..	Oversize +28 ..	−0.2	−1.7	+0.5
	Size −28 +60	−5.9	−11.5	−11.7
	Undersize −60	+7.1	+13.2	+11.2

Methods of Testing Metallic Abrasives

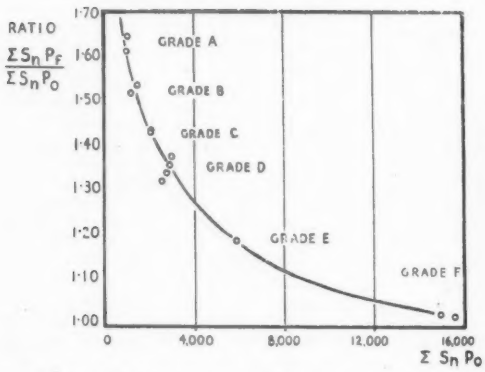


FIG. 6—"CHARACTERISTIC CURVE" FOR A TYPICAL GRIT.

DISCUSSION

MR. FLAVELL raised a point about quality of recent supplies. He felt that the toughness of the grit had been varying considerably lately. The grit seemed to fracture and disintegrate and lose its cutting power very much more quickly than was previously the case. There was increased wastage and rejection. When he went round a grit-making plant during the summer to see how they did the job, there was no material in the yard and he was informed that they were having to buy it, in many cases by surreptitious means. Very violent approaches had been made to the Government to get grit-making established as an important industry. Could Dr. Hurst tell them if anything had been done in that connection, which was just as important as the scientific side of the subject?

Dr. Hurst replied that he was not conscious of any variation of a substantial character in the toughness or quality of the grit produced to-day. He knew there had been difficulties with regard to supplies of raw materials which were not uncommon in every branch of industry; but he thought they might be assured that the commercial people concerned with their organisation were doing their utmost to see to it that ample supplies were available in this country.

On the proposition of Mr. Grainger, a hearty vote of thanks was accorded to Dr. Hurst.

REFERENCES

[1]Papers by Neville, Proc. I.B.F., Vol. XIX, pages 555-575, and Bradshaw, Proc. I.B.F., Vol. XXIX, page 518.

[2]An investigation into the use of metallic abrasives, J. E. Hurst and W. Todd, before Annual Conference of the Institute of Vitreous Enamellers, 1938.

[3]Cf. Bradshaw & Hurst, Proc. I.B.F., Vol. XXXI. page 660

MR. MAKEMSON'S PRESENTATION.

(See facing page)

Founding Industries Liaison Committee

A meeting was held at the Midland Hotel, Derby, on January 15, to establish closer liaison between the founding organisations. The bodies represented were the Council of Ironfoundry Associations, the Association of Bronze and Brass Founders, the Light Metal Founders' Association, and the British Steel Founders' Association, and those present consisted of Mr. P. H. Wilson, Mr. T. Makemson, M.B.E., Mr. R. B. Templeton, Mr. S. H. Russell, Mr. H. V. Shelton, Mr. A. E. Pearce, Mr. Geo. Hyslop, and Mr. F. G. Burrell, of the Association of Bronze and Brass Founders; Mr. A. H. Sturdee, of the Light Metal Founders' Association, and Mr. T. E. Parkinson.

As a result of the meeting, it was decided to establish a Founding Industries Liaison Committee, and Mr. P. H. Wilson, President of the Institute of British Foundrymen, was appointed first independent chairman, and Mr. T. E. Parkinson secretary.

A long agenda was discussed dealing with many matters of common interest, ranging from wear and tear taxation allowances to shortages of ancillary raw materials. As a result, many lines of investigation were set up, and it was agreed to hold periodical meetings for further discussion and action. The feeling was expressed by all the founding organisation representatives that the meeting was a real step forward in the way of progress, and that the strength of the case which the whole of the founding industries could bring to bear upon common problems would be very impressive.

★ Presentation to Mr. T. Makemson ★

Twenty-one Years' Service to the I.B.F.

Last Friday members assembled at the Waldorf Hotel and were received by the President. Following luncheon, the President (Mr. P. H. Wilson) made the presentation. With him on the platform were Mr. Makemson, Sir John Duncanson, Mr. D. Howard Wood (Immediate Past-President), and Mr. Lambert (Assistant Secretary).

Mr. Makemson's Career

Reviewing Mr. Makemson's career, the PRESIDENT said he began it as a patternmaker at Workington, and was subsequently employed in the British Westinghouse Company (now Metropolitan-Vickers Electrical Company, Limited), Manchester, first as a patternmaker, later in charge of foundry and patternshop apprentice training, and finally in the research department.

In those days, as now, he believed in a full day's work for himself, and he had found time to study mechanical engineering at the Manchester College of Technology, later taking a course in metallurgy, and was awarded the Associateship of the College. He was elected to membership of the Institute in 1917, he became Honorary Secretary of the Lancashire Branch in 1923, and was appointed Secretary of the Institute in 1926. In the same year the International Committee of Foundry Technical Associations was formed, and Mr. Makemson was appointed Secretary of that organisation, a position which he had held ever since. He was also Secretary of the International Committee on Testing Cast Iron, and since 1927 had been Secretary of the Manchester Association of Engineers.

In May, 1940, he was seconded to the Iron and Steel Control, becoming successively Deputy Director, Joint Director, and afterwards Director for Iron Castings. He had relinquished that post in July, 1946. During the period from 1940 to 1946 he had continued to maintain close contact with the Institute's activities and the supervision of the work at Headquarters. In January, 1946, he was created a Member of the Order of the British Empire. For many years he had been a Member of the Council of the British Cast Iron Research Association and a member of numerous Committees connected with the foundry industry. He had been particularly active in matters connected with apprenticeship training and education. He was Secretary of the Advisory Committee on Examinations in Foundry Practice and Pattern Making in the City and Guilds of London Institute, and for a few years was Joint Examiner in those subjects.

Progress of the Institute

During his 21 years of service as Secretary, the Institute had increased its membership from about 1,500 in 1926 to the present figure of something over 4,000. Apart from that growth of membership, the Institute's various Branches had shown proportionately increased activity, and obviously there had been correspondingly added responsibility at Headquarters, the burden being borne particularly by the Secretary.

It was pleasing to be able to show publicly the Institute's appreciation of his efforts. His work in the Institute was very much more than just a job in the ordinary way; he had made it a calling, rich in interest and opportunity, which had held him loyal to the Institute during 21 eventful years. One knew how resolutely he had resisted offers of more lucrative appointments.

Special Fields of Activity

MR. D. H. WOOD (Past-President) said there were three matters which he singled out for appreciation by the whole foundry industry, and these were outside Mr. Makemson's general routine work as Secretary:—

(1) The organisation of the International Foundry Technical Committee; Makemson, of course, had been Honorary Secretary of that since its inception and had done a vast amount of work in that position.

(2) His work in connection with the establishment of a Committee dealing with the Recruitment and Training of Foundry Labour.

(3) His efforts in connection with the revision of the Charter in 1946 and the fact that it is at the moment before the Privy Council for further revision. As Chairman of the Committee responsible for the proposed new Bye-Laws, he expressed from personal knowledge the care and attention which Makemson had given to every detail, and the happy way in which he had conducted the negotiations.

Nothing great was ever achieved without enthusiasm, and the success which Makemson won for the Institute and the world-wide reputation he created for himself had, as stated elsewhere, only been brought about by dogged hard work. To Tom, the work had been a labour of love, and in his 21 years' work for the Institute he had demonstrated his profound belief in the future of our ancient and honourable craft. Mr. Makemson's personal creed was: That a man has come to himself only when he has found the best that is in him, and has satisfied his heart with the highest achievement he is fit for. It is only then that he knows of what he is capable and what his heart demands. And, assuredly, no thoughtful man ever came to the end of his life, and had time and a little space of calm from which to look back upon it, who did not know and acknowledge that it was what he had done unselfishly and for others, and nothing else, that satisfied him in the retrospect, and made him feel that he had played the man. That alone seems to him the real measure of himself, the real standard of his manhood.

Presentation to Mr. T. Makemson

Work with the Iron and Steel Control

SIR JOHN DUNCANSON, who also supported the tributes to Mr. Makemson, expressed his sincere thanks for having been invited, as a steel man, to so distinguished a gathering to pay tribute to a man who had played so great a part in building up the Institute's organisation.

The five or six years during which Mr. Makemson had served in the Iron and Steel Control were exceptional; the whole country was under a great strain. During that period those concerned with the Control had lived together, they could not get away from each other; and the business of the day was important. The manner in which that business was conducted, to secure the materials with which to win the war, might have seemed strange at times, but the ultimate result was victory; and the success of the contribution which the foundry industry had made was due largely to the guidance of and the cheerful handling of matters by Mr. Makemson. Sir John said he would be eternally grateful to him for the part he had played in the Iron and Steel Control, which had served the country well. One hoped that he would be spared for many years to serve the Institute, and that he would continue to enjoy the health and happiness he had enjoyed in the past.

THE PRESIDENT then made the formal presentation of an inscribed silver tea service and a cheque to Mr. Makemson.

Mr. Makemson's Acknowledgment

Mr. T. Makemson, M.B.E., responding, said:—Many people have done their job for 21 years and have done it diligently, faithfully and successfully, but few of them receive any particular acknowledgment and fewer still were honoured to the extent that he had been honoured, both last summer when he received the E. J. Fox medal and also at that day's function.

He thanked the members very sincerely for the way they had honoured him by arranging this special meeting, for the tributes which had been paid, and for the very handsome manner in which they had ratified their thanks by presenting him with such a gift.

When he was appointed Secretary, the President was Mr. Faulkner. They had worked together for some years before then, and continuously together ever since —and had preserved close personal friendship. He thanked Mr. Faulkner for the very noble tribute which he paid him a few weeks' ago in his leading article in the FOUNDRY TRADE JOURNAL.

When he was appointed, the membership was about 1,600, of whom about 400 were in arrears with their subscriptions. The membership to-day was about 4,200, and the number of members in arrears comparatively small. But not only had the membership grown, but the Institute's activities had expanded very considerably. During the last 21 years it had undertaken all kinds of additional work for the benefit of the industry, educational and technical, national and international, and it was increasingly co-operating with other bodies with similar aims. A point he stressed was that any success he had achieved was due very largely to the people with whom he had worked during the last 21 years.

He was grateful to Sir John Duncanson and to Sir Arthur Fleming (the man who gave him his first job when he left the patternmaker's bench) for taking so prominent and active a part in these proceedings and delivering the lecture.

The Foundry Industry

The people who founded the Institute in 1904 were among the first people in this country to recognise the fact that the foundry industry was still essentially a craft, but a craft capable of development on scientific lines. He claimed that their work in the early years of this Institute was fundamental in putting the foundry industry upon the scientific and systematic basis on which large sections of it operated to-day. When he became Secretary much of this spade work had already been accomplished, largely as a result of the Institute's inspiration. Much of the phenomenal progress which has been made since then has been due not only to the Institute but also to other organisations which have come into being, also to the enterprise of various firms and to the genius of many individuals. He further claimed that the Institute had been the inspirer of a large part of that work. He had very little doubt of the future of the foundry industry. All sorts of new developments were opening out. It was producing materials to specifications undreamt of a few years ago. It was finding many kinds of new applications for its products. Some things were being lost, but the gains were very much more than the losses. He believed that the future of the industry lay in the directions of:—(*a*) Increasingly improved quality of the products, and (*b*) increasing attention to quantity production.

Both of these lines of progress could only be made possible by the improvement and development of foundry technique, and it was in that direction that the Institute would play an even more important part in the prosperity of the industry in the future.

Finally he reminded his audience that he was still working actively. His time for retirement would not come for a few years yet, and he hoped to continue during the years to come to serve the Institute and the industry as actively and as conscientiously as he had tried to do in the years that had passed.

International Approbation

There followed the presentation by Mr. V. C. Faulkner of the bound album of congratulatory telegrams from the constituent members of the International Committee of Foundry Technical Associations, and the presentation by Mr. Delport of the addresses and the inscribed wallet on behalf of the French Associations.

The spontaneous gesture on behalf of the two French associations, said Mr. Delport, symbolised the profound friendship existing between the foundrymen of France and Great Britain. The foundrymen of France wished to express their appreciation of the very great part

which Tom Makemson had played in establishing and strengthening those close relations.

MR. MAKEMSON, in a further response, said the associations formed through the International Committee of Foundry Technical Associations had been very happy. Apart from the value of the work of that body, which he believed had been considerable, the bringing together of technicians from various nationalities had done much to develop the industry and to enhance international understanding. He had been fortunate in making very many friends thereby.

As showing the closeness of the relationships established with friends overseas, he said they had not had the good fortune to meet their Italian friend, Guido Vanzetti, for some years; but recently a present had arrived, and inside was a note conveying the good wishes of Mr. Vanzetti. It was most pleasurable to be able to renew such friendships which had been broken temporarily by the war.

"THE INTER-RELATION OF THE ENGINEERING AND THE METALLURGICAL INDUSTRIES."

At this stage MR. R. B. TEMPLETON (Senior Vice-President of the Institute) presided, and introduced SIR ARTHUR FLEMING, who afterwards gave an interesting lecture on the above subject.

Early Association with Mr. Makemson

Sir Arthur said it was a very great pleasure to him to be present on that very happy occasion and to pay his tribute in addition to the many eulogies that had been heaped upon his old friend, Tom Makemson. His own association with Tom Makemson extended back very much further than 21 years. He had joined the Company with which Sir Arthur was associated 37 years ago, and 27 years ago had joined him in some quite pioneering work in connection with industrial education and training. Those who had known him in those early days had not much doubt about the success of his future, and it was perhaps his pleasing personality no less than his knowledge of foundry work that had marked his advance. From what one had heard that day, that characteristic of his must have been one of his very great assets in the Institute also. His old colleagues and friends had watched his career with great interest and were particularly pleased by the recognition of his work in such a signal way. The Presidents of institutions came and went, members of Council were not immortal, but the big part of the personnel was usually the Secretary. There was some truth in the old saying that "The hand that writes the minutes rules the Board," and all who knew him would join in the hope that for very many years to come he could continue his wise guidance in the affairs of the Institute.

Sir Arthur Fleming's Lecture

In his lecture, Sir Arthur Fleming first showed how, by close co-operation between the metallurgist and the engineer, the largest steel forgings were provided free from defects. The latest methods for assuring quality, such as sulphur prints, magnetic and fluorescent testing for surface cracks and supersonic testing for internal defects were reviewed. The development of transformer practice and the reduction in mass through the use of silicon steels was next dealt with. Then the composition of magnets was outlined, indicating the great progress achieved through the use of alloys. Other subjects included were the development of the electric melting furnaces, sintered tool steels and welding. Finally, he made some references to nodular cast iron and atomic energy.

Vote of Thanks

The CHAIRMAN, proposing the hearty thanks of the meeting to Sir Arthur Fleming for his address, said he had been intensely interested in the references made to the advance in the development of the new cast irons, such as the acicular irons, nodular irons and high-duty irons. He had often wondered, however, whether in the engineering industry all the advances made had become known. It seemed that the engineer still looked upon cast iron as a rather unreliable, brittle material, and it was very refreshing to hear Sir Arthur say that appreciation of it was becoming more evident in the engineering industry.

He was very proud to have the privilege of proposing the vote of thanks. He had learned that Sir Arthur had contributed more than a score of scientific Papers before various technical institutions and other bodies in this and other countries; having heard his lecture that afternoon, one could well appreciate it, for practice did make for perfection. It would be agreed that the lecture had been delivered in a very lucid manner, and the material it contained was of very high quality.

MR. NOEL NEWMAN (Junior Vice-President), seconding, said it could be regarded as a personal compliment to Mr. Makemson that Sir Arthur had attended that happy function and had delivered his interesting lecture. It had covered a very wide field of interest, and it was indeed a pleasure to second the expression of thanks to Sir Arthur.

(The vote of thanks was further supported by the President, Mr. P. H. Wilson, and was carried with enthusiasm.)

SIR ARTHUR FLEMING, in a brief response, said it had afforded him tremendous pleasure to attend and take part in the celebrations, to pay his tribute to his old friend Tom Makemson, and to address so appreciative an audience.

Films and Film Strips

The Information Officers at British Missions in most overseas countries are provided with film projectors and with projectors on which film strips can be shown. Representatives of British firms visiting overseas countries are making use of these facilities to show films or film strips dealing with their products. Exporters who wish their representatives to take advantage of this service, where it exists, are invited to communicate with the Export Promotion Department of the Board of Trade, 35, Old Queen Street, London, S.W.1.

Scottish Foundry Trade Review

By Our Scottish Representative

In many respects 1947 has been a notable year in the Scottish ironfounding industry. Although production generally remained below pre-war levels, a steady upward trend persisted, and on the whole the year was marked by solid achievement in the face of difficulties. The year has been an important one, too, in other respects. It witnessed the rapid development of new techniques, the introduction of the five-day week, and a general improvement in amenities for the workers.

The year 1947 has also left a heritage of unsolved problems, not all of which, however, are peculiar to the foundry trade. Man-power resources were still below requirements and desperately-needed new machinery was equally difficult to obtain. More serious in its implications, however, was the shortage of pig-iron, which was being delivered on a hand-to-mouth basis. These were the limiting factors on the past year's production figures. What hope does 1948 hold for their solution?

Man-power shortage presents no easy solution. It is well known that the war not only stopped the normal flow of apprentice labour into the foundries, but also drained the industry of many skilled workers who elected at its close not to return to the moulding shop. Recruiting efforts have been made, but they have not been conspicuously successful. Carron Company experimented with a system of "green" labour, but the results were not up to expectation. The proposed foundry school at Burnbank to train apprentices has not yet become a reality.

Innovations presenting more attractive conditions of employment have been more successful. Following the lead given in 1946 by the Gowanbank Foundry, Falkirk, many foundries in the area have installed baths for their workers, and moulders legitimately jested that, after making baths for half the world, they had finally got around to making them for themselves.

In February the five-day week was introduced. To those unacquainted with the trade, there might seem something paradoxical in the granting of a five-day week while the industry was so seriously undermanned, even as an inducement to prospective workers to enter it. In fact, however, the five-day week caused little or no loss of production. It had long been local foundry practice to make castings on five days only, and a sixth-day cast was practically unknown.

Yet none of the measures taken can be said to have solved the man-power problem, or even to promise a full solution. There was only one alternative, and Scottish foundries turned increasingly towards it in 1947—that was mechanisation. It was the lack of the traditional type of moulder who was an artist as well as an artisan which has caused the forced development of mechanised moulding processes.

Machine-moulding is not new. At Burnbank Foundry, Falkirk, German-made moulding machines were in use as long ago as 1910. Yet, in the light castings industry, mechanised moulding has only recently won its way over the craftsman moulder, largely as a result of the labour shortage. It is not a complete answer to the man-power problem, but it suggests a way round. One distinct advantage is that with the new type of equipment long years of training in a highly-skilled trade are no longer necessary. Men without previous experience can be taught to handle these machines competently in a matter of weeks.

Recent developments in mechanisation include a plant at Carron Company's Low Foundry which, during wartime, was engaged on the manufacture of tank track links. This plant has now been converted for the manufacture of light iron castings, such as bottom grates, frets, and so on. Also at Carron Company a new mechanised bath foundry, operating from three separate Sandslinger units, came into production. A new enamelling department at this foundry is among recent advances.

Grahamston Iron Company have also pledged themselves increasingly to mechanisation, and during the year two newly-fitted self-charging cupolas were brought into use to supply the new mechanised plant with an adequate and steady flow of molten metal. Other foundries have also developed along the lines of greater mechanisation. Some, including the Grange Iron Company, which had already become highly mechanised in certain processes, continued in a quickened drive towards new methods. Smith & Wellstood, Limited, Bonnybridge, are already embarked on plans for a new completely mechanised foundry, which will be of up-to-date all-steel construction. Mechanisation, however, presents its own problems, the principal being that the plant is difficult to get, even on priority order.

While carrying out running repairs to its structure, the industry strove bravely to cope with the flood of orders, both current and those which had accumulated since 1939. Prospects at the beginning of 1947 so far as markets were concerned had never appeared brighter. The housing programme was in full swing, and the Government's demands for components seemed limitless. Then, following the fuel crisis and the economies introduced, the housing drive slackened. Government spokesmen indicated that the foundries might be switched partially to export work which was then only an infinitesimal proportion of their output. Foundries were ready to adapt their products to the export market, provided they were given a firm indication of what was expected of them. But as the year closed they were still waiting.

Yet, all in all, prospects for this year appear to be bright. New problems there will be undoubtedly, but to the industry which has shown such adaptability in the past new problems are but stepping-stones to future successes.

THE ALPHABETICAL INDEX for the FOUNDRY TRADE JOURNAL, Vol. 82 (May to August, 1947) is now available. Will readers who require a copy make early cation to 49, Wellington Street, London, W.C.2.

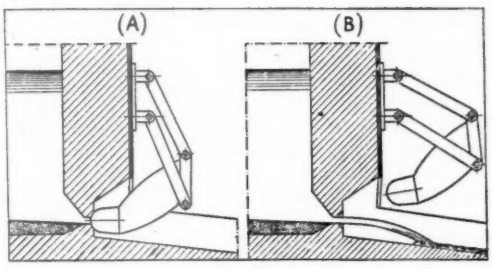
House Organs

Winget Life Christmas Number. Published by Winget, Limited, Rochester, Kent.

Amongst items of general interest is the news that Mr. Arthur T. Thorne has joined the Board of Directors. Mr. George Dickson has written an article on a visit to America, but in his analysis the 1930 slump is ascribed to inequalities of wealth instead of the over-development of the instalment system of buying plus stock exchange gambling. The introduction of graphs and statistics of a serious character is novel in house organs of this type. The reviewer prefers the latter as the former can lead to over simplification. For instance, correlating the man-power graph with the export graph for years 1938 and 1947, it would appear that export production per man had increased considerably, but if there be a subtraction for the non-productive staff, the figure would seem to follow arithmetic progression. The Winget Life certainly improves with each issue.

Bulletin of the *Association Amicale des Anciens Elèves de l'Ecole Supérieure de Fonderie* (Foundry High School Old Students' Association). 11th year, No. 3.

Whilst most of the matter printed is only of interest to the ex-students, there is an article referring to a prize given to Mr. Guillamon for developing the use of a bottom pouring ladle stopper end, in conjunction with a contraption of levers for botting up cupolas and the like. A sketch of the gadget illustrates this note.



Publication Received

The Commercial Applications of Zinc Alloy Gears. Published by the Zinc Alloy Die Casters' Association, Lincoln House, Turl Street, Oxford.

Of all publicity matter issued by foundry employers' associations, the reviewer deems this to be the nearest approach to the ideal. It discloses the existing field, helps the designer, well illustrates the subject and gives information about use—in this issue lubrication is dealt with. The booklet, which runs to 16 pages, is equally divided as to illustrations and letterpress. It is available to our readers on writing to "Z.A.D.C.A."

New Catalogues

Foundry Supplies and Equipment. Foresight was shown by the Fordath Engineering Company, Limited, of Hamblet Works, West Bromwich, when, on the occasion of their silver jubilee in 1945, they published a general catalogue of handsome appearance carrying a pocket on the inside back cover. This has enabled the firm, whilst retaining a general overall picture of their productions to include leaflets giving more detailed information and in some cases to list and number spare parts for facilitating replacements. Another leaflet gives foundation details for a definite machine. A surprising feature of these leaflets is that they carry no reference numbers or other type of identification. They are of uniform size and are commendably clear both as to type and illustration. The reviewer has but one technical suggestion to make, and that is in connection with the "Glyso No. 4 Compound" leaflet. In detailing an oil sand core mixture, it states "sufficient water must be added to give suitable ramming consistency." Surely in these enlightened days, either a percentage figure or a short range could be specified. Copies of the catalogue and the seven leaflets are available to our readers by writing to Hamblet Works.

Fans. It is probably the paper shortage which decided Keith Blackman, Limited, of Mill Mead Road, Tottenham, London, N.17, to combine descriptions of so many of their products into one catalogue under the general heading of "Fan Engineering Equipment." Moreover, they have made an excellent selection, and in general have displayed their wares intelligently and artistically, though *force majeure* some pages do resemble the catalogues issued by mail order concerns. The brochure runs to 24 pages, mainly of illustrations, many of which are of direct interest to the foundry industry. There are fans for man cooling; for ventilating and cupola blowing; air heaters, washers and filters; dust settlers, and a host of other plant one finds in and around foundries. If the object of the booklet is to remind executives just how far equipment enters into and often solves their day-to-day production problems, then it has been well accomplished.

Hotwire Vacuum Switches. Sunvic Controls, Limited, of 10, Essex Street, Strand, London, W.C.2, have sent us a brochure describing in simple language the principles and practical applications of vacuum switches for electrical circuits. They are such that a furnace may be controlled to fine limits of temperature by making the pyrometer turn it off and on automatically as often as required without deterioration of switch contacts, and without wastage. The reviewer had previously encountered these switches in the laboratory, but were pleased to learn they can be adopted for works' controls—to turn the tap off when a tank is full, to stop a mixer, and, in short, act in numerous ways to reduce operating costs.

Pig-iron and Steel Production in Great Britain

The following particulars of pig-iron and steel production in Great Britain have been extracted from the Statistical Bulletin for December, 1947, issued by the British Iron and Steel Federation. Table I gives the production of pig-iron and ferro-alloys in November, with the number of furnaces in blast at the end of the month; Table II, production of steel ingots and castings in November, and Table III, deliveries of non-alloy and alloy finished steel. Table IV summarises activities of the steel industry during six months ended November, 1947.

TABLE I.—*Weekly Average Production of Pig-iron and Blast-furnace Ferro-alloys, November,* 1947. (*Thousands of tons.*)

District.	Furnaces in blast, Nov.29	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts., Northants, and Essex	24	—	12.4	23.0	1.1	—	36.5
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Ches.	6	—	6.7	—	—	1.7	8.4
Yorkshire (incl. Sheffield, excl. N.E. Coast)							
Lincolnshire	13	—	22.9	—	—	—	22.9
North-East Coast	25	7.7	34.3	0.4	—	1.4	43.8
Scotland	9	0.7	8.4	2.2	—	—	11.3
Staffs., Shrops., Worcs. and Warwick.	7	—	6.5	1.3	—	—	7.8
S. Wales and Monmouthshire	7	2.8	18.1	—	—	—	20.9
North-West Coast	7	13.7	—	0.2	—	0.4	14.3
Total	98	24.9	109.3	27.1	1.1	3.5	165.9
October, 1947*	97	24.2	107.4	25.6	1.5	1.9	160.6
November, 1946	98	21.2	102.6	26.1	1.4	2.6	153.9

TABLE III.—*Weekly Average Deliveries of Non-alloy and Alloy Finished Steels.* (*Thousands of tons.*)

Product.	1946.	1947 (1st 11 months).	1946.	1947.	
			Nov.	Oct.*	Nov.
Non-alloy steel:—					
Heavy rails and sleepers	9.0	7.6	7.6	7.8	7.9
Heavy and medium plates	30.9	31.6	34.4	33.7	35.9
Other heavy steel products	31.9	31.8	33.9	32.8	34.1
Light rolled products (excl. wire rods and alloy steel bars)	48.9	49.7	55.7	57.2	54.5
Ferro-concrete bars	3.2	3.1	3.1	3.7	3.7
Cold rolled strip	4.2	4.6	4.9	5.0	4.9
Bright steel bars	4.5	4.8	5.2	5.4	6.1
Sheets, coated and uncoated	22.4	24.2	23.4	25.3	26.7
Tin, terne and black-plate	10.4	12.2	12.3	14.0	13.3
Tubes	14.0	13.1	16.0	14.7	15.2
Wire	11.8	10.9	12.6	11.5	12.1
Tyres Wheels and Axles	3.4	3.3	3.8	3.6	3.5
Forgings	4.9	5.0	5.5	5.3	6.4
Castings	2.9	3.0	3.3	3.2	3.5
Total	202.4	204.9	221.7	223.2	227.8
Alloy steel‡:—					
Plates	0.3	—	0.2	—	—
Tubes	0.2	0.3	0.4	0.4	0.5
Bars, sheets, strip and wire	2.9	3.7	3.8	4.5	4.3
Forgings	1.6	1.7	1.9	2.2	2.0
Castings	0.6	0.6	0.5	0.7	0.8
Total	5.6	6.3	6.8	7.8	7.6
Total U.K. production†	208.0	211.2	228.5	231.0	235.4
Less Intra-industry conversion	16.4	17.8	20.1	24.1	25.1
Total U.K. deliveries	191·6	193.4	208.4	206.9	210.3
Add Deliveries of Imported finished steel	—	2.1	—	2.8	3.8
Total deliveries of finished steel	191.6	195.5	208.4	209.7	214.1

† Includes finished steel made from imported ingots and semi-finished steel.
‡ Excludes high-speed steel.

TABLE II.—*Weekly Average Production of Steel Ingots and Castings in November,* 1947. (*Thousands of Tons.*)

District.	Open-hearth.		Bessemer.	Electric.	All other.	Total.		Total ingots and castings.
	Acid.	Basic.				Ingots.	Castings.	
Derby, Leics., Notts., Northants, and Essex	—	—	(Basic) 8.9	1.4	0.2	10.0	0.5	10.5
Lancs. (excl. N.W. Coast), Denbigh, Flints., and Ches. / Yorkshire (excl. N.E. Coast and Sheffield)	1.6	21.4	—	0.5	0.5	23.0	1.0	24.0
Lincolnshire	—	28.0	—	—	0.1	28.0	0.1	28.1
North-East Coast	1.4	53.7	—	0.7	0.4	54.9	1.3	56.2
Scotland	6.2	31.4	—	1.4	0.7	38.0	1.7	39.7
Staffs., Shrops., Worcs., and Warwick	—	13.4	—	0.6	0.8	13.5	1.3	14.8
S. Wales and Monmouthshire	6.7	41.5	(Basic) 4.8	0.8	0.1	53.6	0.3	53.9
Sheffield	8.3	22.4	—	7.4	0.6	37.1	1.6	38.7
North-West Coast	0.6	2.4	(Acid) 3.6	—	0.1	6.5	0.2	6.7
Total	24.8	214.2	17.3	12.8	3.5	264.6	8.0	272.6
October, 1947*	26.4	214.5	18.6	12.4	3.4	267.6	7.7	275.3
November, 1946	27.8	202.8	19.1	10.8	3.2	256.3	7.4	263.7

*Five weeks.

(*Continued at foot of facing page.*)

United Kingdom Tin Position

The Ministry of Supply has released the following figures showing the United Kingdom tin position for the month of November last:—

	Ministry.	Consumers.
	Long tons.	Long tons.
TIN METAL:		
Stocks at November 1	6,438	2,708
Arrivals	—	—
Production	2,603	—
	9,041	2,708
Deliveries:		
To U.K. consumers.. .. 2,602	—	2,602
For export 113	2,715	—
	—	5,310
Consumption	—	2,512
Stocks at November 30	6,326	2,798*
TIN ORE (Tin content):		
Stocks in U.K. at November 1 ..	6,537	—
Stocks in U.K. at November 30 ..	6,792	—

* Calculated. Reported 2,776 tons.

Allocations of Tin Metal

Interim allocations of tin metal have been made by the Combined Tin Committee for the first half of 1948 amounting to 17,703 long tons. The allocations now made represent more than half of the total allocation that each country can expect for the first six months of this year in view of the estimated production of tin metal available for export up to June 30, 1948, and after taking into account the probable requirements of many countries which have not yet been presented to the Committee. It is pointed out that the supplies of tin metal available for allocation during the first six months of this year will fall short of the amount available during the last half of 1947, mainly because all the wartime stock accumulations found in the Far East have now been distributed.

Supplies may be obtained from the following sources:—The United Kingdom, on behalf of the U.K. and Malaya; Hong Kong; the Netherlands; Belgium; China, and Siam. In addition, small demands of certain Latin-American and Middle-Eastern countries may be met from the above sources and the United States.

Ferguson Tractors for America

Harry Ferguson, Limited, Coventry, have received a $20-million order for tractors for America. It is stated that if the delivery of still further tractors can be guaranteed after the completion of the initial order, America is prepared to take up to $60,000,000 worth. Officials of the company say that it will not be possible to meet the demand unless they get sufficient steel.

The order, which is said to be the largest contract received in Britain since the beginning of the export drive, was placed by the American firm of the same name as the English company, and the first shipment, valued at $250,000, left last week. Each succeeding week the management of the Banner Lane plant of the Standard Motor Company, Limited, where the tractor unit is built under licence, hopes to double the value of the first consignment until the order is completed.

Mr. Alan Botwood, managing director of Harry Ferguson, Limited, states that the order is the spearhead of the company's export drive to capture world markets for British-made agricultural machinery.

Ewart & Son's Scheme

A scheme for the reorganisation of Ewart & Son, Limited, geyser manufacturers and sheet-metal workers, of Letchworth, Herts, by the formation of a new company, is to be voted on by the shareholders next Wednesday. The new company, Ewart Industries, Limited, is being formed as a private company with an authorised capital of £100 and will be converted into a public company with a capital of £280,000. The new company will purchase from the old its assets and undertaking as a going concern in consideration for taking over its liabilities, the payment of £145 in cash, and the issue, created as fully paid up, of 179,998 ordinary shares. The new company, it is intended, should change its name to Ewart & Son, Limited, and the old company will be known as Ewart Holdings, Limited.

When the agreement for sale has been entered into, the Imperial Continental Gas Association will pay in cash at par for 200,000 preference shares in the new company and will hold the majority of votes at a general meeting.

PIG-IRON AND STEEL PRODUCTION IN GREAT BRITAIN (*Continued from previous page.*)

TABLE IV.—*General Summary of Pig-iron and Steel Production.* (*Weekly Averages in Thousands of Tons.*)

Period.	Iron-ore output.	Imported ore consumed.	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Steel (incl. alloy). Imports.	Steel (incl. alloy). Output of ingots and castings.	Steel (incl. alloy). Deliveries of finished steel.	Steel stocks.†
1938	228.1	89.2	130.0	117.9	16.2	200.0	—	—
1946	234.1	115.4	149.3	147.0	8.3	244.1	191.6	1,223.9
1947—June	222.7	125.2	144.3	157.6	7.6	254.0	213.2	865.6
July*	209.7	123.6	143.5	128.9	7.1	211.7	183.1	855.2
August	206.8	127.6	147.2	138.7	5.5	234.2	177.6	816.1
September	229.2	129.6	150.1	161.5	8.0	266.1	204.8	800.4
October*	226.3	144.5	160.6	166.4	5.1	275.3	209.7	782.0
November	225.0	153.5	165.9	164.2	8.3	272.6	214.1	789.2

* Five weeks. † Stocks at the beginning of the years and months shown.

Personal

MR. H. C. E. MILLER has been appointed a director of the Rheostatic Company, Limited.

MR. H. S. CRUMP has been appointed manager of the Manchester office of the Brightside Foundry & Engineering Company, Limited.

MR. C. K. F. HAGUE, managing director of Babcock & Wilcox, Limited, has been elected president of the British Engineers' Association.

MR. J. L. FRANCIS has relinquished his position as technical director of Poole Foundry, Limited, Dorset, to rejoin Foundry Services, Limited, as senior metallurgist.

MR. A. RITCHIE, welfare supervisor for 18 months with Richardsons, Westgarth & Company, Limited, Hartlepool, has been appointed labour and welfare manager at Portsmouth.

MR. WALTER SEADON, secretary of S. P. Austin & Son, Limited, shipbuilders, etc., of Sunderland, has retired after 56 years' service with the company. He will be succeeded by MR. G. H. COMPTON.

MR. R. M. GILLIES, London manager for 29 years of G. & J. Weir, Limited, engineers and founders, of Glasgow, retired recently. He is succeeded by MR. ANDREW C. SMITH, who has been with the company for 17 years.

MR. C. F. RUSSELL has been appointed chairman of the Aero Piston Ring Company, Limited, Hunslet, Leeds, and MR. L. H. MAIDMAN and MR. L. P. GIBSON, of Specialloid, Limited, have joined the board of the Aero Piston Ring Company.

MR. G. E. TOULMIN has returned home after undergoing treatment in a Cambridge hospital, but will be unable to resume his duties as secretary of Baker Perkins, Limited, manufacturing engineers, of Peterborough, for several weeks.

MR. J. L. HENDERSON, formerly Public Relations Officer to the British Iron and Steel Federation, has been appointed to a similar position with the British Transport Commission. Latterly Mr. Henderson has been director and general secretary of the Advertising Association.

MR. D. C. HENDRY, general manager of the iron and steel works at the Corby branch of Stewarts and Lloyds, Limited, has been appointed general manager and chief engineer of the planning and reconstruction department of the works. He has been succeeded in his former position by MR. J. GLEN.

MR. G. E. DONO, a director of Morris Motors, Limited, has been appointed to assume the management of the company's sheet-metal works. Two other directors, MR. H. C. R. MULLENS and MR. S. V. SMITH, will manage the company's factories in the Midland region and the Oxford region, respectively.

MR. J. B. CURRY and MR. G. T. BOWERMAN have been appointed directors of the A.B.C. Coupler & Engineering Company, Limited, in place of LORD QUEENBOROUGH, who has resigned, and the late Mr. A. R. Baker-Beall. In consequence of the resignation of Lord Queenborough, MR. J. S. MAGRATH has relinquished his position as his alternate.

MISS ANNIE ORTON, a director of Orton, Sons & Spooner, Limited, engineers, of Burton-on-Trent, who has been with the company for 50 years, received a presentation recently to mark the occasion. MR. H. P. MOULD, who made the presentation, has also been with the firm for 50 years, and he was presented with a gold watch by Miss Orton.

MR. R. B. PULLIN has resigned from the position of managing director of R. B. Pullin & Company, Limited, gyroscopic engineers, etc., of Brentford, but remains chairman of the company. MR. P. J. ELLIS, general manager, has been appointed managing director, and MR. B. T. DYETT has been elected an additional director, while retaining his position as secretary.

MR. T. P. EVERETT, until recently manager of the land department of the Hartlepool Engine Works of Richardsons Westgarth & Company, Limited, has been appointed a director of the company. MR. B. B. WYATT has been appointed manager of the land department, while MR. W. E. LOVERIDGE will continue as resident director in charge of the Hartlepool Works.

SIR HENRY TIZARD, F.R.S., was installed as president of the British Association on January 9. He succeeds SIR HENRY DALE, F.R.S. The new president was permanent secretary to the Department of Scientific and Industrial Research from 1927 to 1929, when he became Rector of the Imperial College of Science and Technology, a position he retained until 1942. In that year Sir Henry was appointed president of Magdalen College, Oxford. He has been closely identified with the development of aviation. He was awarded the Albert gold medal of the Royal Society of Arts in 1944, while two years later he received the gold medal of the Franklin Society of Philadelphia.

Wills

BROOK, N. K., of Huddersfield, lead-pipe manufacturer £50,250

WONFOR, H. L., of Bath, late manager of Vickers-Armstrongs, Limited £18,271

CHRISTIANSON, T. C., of the switchgear sales department of Metropolitan-Vickers Electrical Company, Limited £8,539

HALLAM, GILBERT, formerly Sheffield and district representative of Edgar Allen & Company, Limited, steel manufacturers, engineers, etc., of Sheffield £6,680

A METALFLOW LABORATORY is to be built in Sheffield by the British Iron and Steel Research Association at an estimated cost of £200,000. Plans for the laboratory have been completed, but the Association have still to acquire a site and to obtain building permits. Meanime, work is being carried on at the temporary premises at Doncaster Street, Sheffield.

Iron and Steel Output in 1947

The Christmas and New Year holidays were reflected in the steel-production figures for December, the annual rate of 12,646,000 tons comparing with 12,289,000 tons in December, 1946, which included the Christmas but not the New Year holiday. Nevertheless, the weekly average rate of production last December was well above that for the corresponding month of 1946. The target of 12¼ million tons for 1947 was reached in the 52 weeks ended December 27, when the total production amounted to 12,515,000 tons. In the full 53-week year ending January 3 the total amounted to 12,724,000 tons.

The quarterly figures show how the fuel difficulties, in the first part of the year particularly, held back production. During the second part of the year output considerably exceeded the previous year's rate of production, while the fourth-quarter rate was above the 13.5 million-ton target set by the Prime Minister in his speech of August 6 as the winter rate of production. Raw-material supplies were not coming forward in the fourth quarter at a rate sufficient to maintain the current level of output, which was only achieved by drawing on stocks.

Pig-iron output, which is less affected by holiday influences, was at the rate of 8,561,000 tons a year, compared with 7,966,000 tons in December, 1946. It increased throughout the year as supplies of coke improved. Even in the fourth quarter, however, coke shortage limited production to a rate of 8.5 million tons, compared with a requirement of over 9 million tons needed to maintain steel output at 14 million ingot tons. Better supplies of coke and scrap are now coming forward and, if they are maintained, the 14-million-ton rate should be achieved in 1948.

Latest output figures compare as follow with earlier returns:—

	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
	Tons.	Tons.	Tons.	Tons.
1947—November ..	165,900	8,617,000	272,600	14,174,000
December ..	164,600	8,561,000	243,200	12,646,000
1st quarter ..	134,400	6,989,000	216,000	11,231,000
2nd quarter ..	141,600	7,363,000	244,100	12,694,000
3rd quarter ..	146,700	7,628,000	235,400	12,241,000
4th quarter ..	163,600	8,505,000	263,100	13,679,000
1946—November ..	153,900	8,002,000	263,800	13,715,000
December ..	153,200	7,966,000	236,300	12,289,000
1st quarter ..	145,000	7,566,000	242,600	12,617,000
2nd quarter ..	150,500	7,827,000	252,100	13,111,000
3rd quarter ..	146,600	7,622,000	230,000	11,953,000
4th quarter ..	154,400	8,029,000	251,700	13,088,000

PRODUCTION OF steel ingots at the East Moor Works, Cardiff, of Guest Keen Baldwins Iron & Steel Company, Limited, in the week ended midnight on January 3, totalled 13,264 tons. This compared with the previous best output of 11,933 tons for the week ended July 6, 1946.

Reallocation of Grantham Factories

Production of Light Tractors

The Board of Trade announces that the surplus Government factories Nos. 3 and 4 at Grantham have been reallocated to Newman Industries, Limited, electrical and mechanical engineers, etc., of Yate, Bristol, for a period of two years in the first instance. During that time the company intend to produce light tractors, for which plant and a quantity of parts have been acquired from Grantham Productions, Limited. The company wish to continue in production at the end of the two years to the extent to which steel supplies prove to be available.

The No. 2 factory has been reallocated to the Ransome & Marles Bearing Company, Limited, Newark, who will use it for the production of ball bearings, especially bearings for mining conveyors.

Mr. A. J. Newman, chairman and managing director of Newman Industries, Limited, stated this week that the company do not intend to proceed with production of the "people's car" at present, but he does not rule out the possibility that the firm may branch out into car production later. A licence would be necessary from the Ministry of Supply. Their present plans are to continue the production of light farm tractors at Grantham and to use part of the factories for increasing production of mining equipment, such as pumping plant and flame-proof electric motors.

Research in Industry

Industry could not give the country what it wanted in increasing abundance and decreasing costs unless science became more of a partner and less of a Cinderella, said Mr. Herbert Morrison, Lord President of the Council, in a speech at Letchworth last week. He said that the Government was taking steps to bring science into the forefront of British industry. The Minister said there had been an increase in the number and the effectiveness of research associations in industry, but there was room for more.

In future we must get used to setting aside for science bigger resources and more man-power, as the Government was already doing, if we were to get maximum results.

Appleby-Frodingham Appointments

United Steel Companies, Limited, have announced a number of appointments at the Appleby-Frodingham Steel Company, Limited. Lt.-Cdr. G. W. Wells has been appointed joint general manager with Mr. W. B. Baxter, while Mr. A. Robinson has become technical consultant and a member of the board. Engr. Rear-Admiral C. W. Lambert has been appointed general works manager, and Mr. A. Jackson, Mr. G. D. Elliot and Mr. W. Geary, works managers. Mr. K. Paterson is to succeed Engr. Rear-Admiral Lambert as chief mechanical engineer, and Mr. J. L. Gaskell has been appointed chief electrical engineer.

News in Brief

BRITISH ALUMINIUM COMPANY, LIMITED, has bought No. 46, Berkeley Square, London, W.1, for use as offices.

THE GAUGE AND TOOL EXHIBITION is to be held at the New Hall, Vincent Square, London, S.W.1, from January 26 to February 6.

PALMERS HEBBURN COMPANY, LIMITED, have completed the reconversion of the Blue Funnel liner Menestheus, which during the war served as an amenity ship.

MARCONI'S WIRELESS TELEGRAPH COMPANY, LIMITED, has completed to schedule a contract for nearly £300,000 worth of equipment for China's international telephone circuits.

THIS YEAR'S MEETING of the British Association will be held at Brighton from September 8 to 15, when prominence will be given to scientific matters which have a bearing on the economic crisis.

THE GOVERNMENT is to publish in the second half of next month the White Paper surveying the economic situation for 1948. It is understood that it will follow the lines of that issued in February of last year.

A FACTORY ON THE Hartlepool Trading Estate, originally allocated to a furniture-making company, is now to be let to Siemens Bros. & Company, Limited, electrical engineers and contractors, of Woolwich, London, S.E.18.

A £500,000 ORDER FOR 50 heavy shunting tank locomotives has been received by W. G. Bagnall, Limited, Stafford. The order is part of a £1,500,000 contract placed by British Railways with five railway engineering companies.

ZINC PRODUCTION of the Electrolytic Zinc Company of Australasia, Limited, in the year ended June 30, 1947, at 70,314 tons, was 10,144 tons below the previous year's output, and represented approximately 82 per cent. of the present plant capacity.

STEEL & COMPANY, LIMITED, electrical and mechanical engineers, etc., of Sunderland, has obtained permission to issue a further 150,000 of 6 per cent. preference shares of £1, which the board propose to offer to existing shareholders *pro rata* to their present holdings.

C. A. PARSONS & COMPANY, LIMITED, Newcastle-upon-Tyne, has received orders for 14 turbo-alternators (50,000 kw. or over) for various power stations in this country. During 1947 the company's transformer department booked more orders than in any previous year.

CEMENTATION COMPANY, LIMITED, Doncaster, has received a contract from Manchester City Corporation to build a 10-mile tunnel forming part of an aqueduct from the Lake District to Manchester. It will take six years to complete, and the cost is estimated at between £2 and £3 million.

THE SELLING PRICES of lead sheet and pipe have been reduced by £2 per ton as from January 1. This has been agreed between the Ministry of Works and the Lead, Sheet and Pipe Manufacturers' Federation, following suspension of imports of lead sheet. Lead sheet is now quoted at £106 10s. and lead pipe at £107 15s. per ton.

AN AGREEMENT has been reached between Colliery Engineering, Limited, Sheffield, and Head, Wrightson & Company, Limited, Thornaby-on-Tees, Yorks, whereby Head, Wrightson & Company have been granted the rights to design, manufacture and sell coal-preparation plant under the designs, patents and licences owned by Colliery Engineering, Limited.

THE Engineering and Industrial Equipment (Home and Export) Exhibition will open at the Royal Horticultural Hall, Vincent Square, London, S.W.1, for two weeks from March 10-24. Display space is limited, and firms interested in exhibiting should make immediate application to the organisers, "Britain's Best" Exhibitions, 17-18, Henrietta Street, Covent Garden, London, W.C.2.

PRESIDING AT the recent annual meeting in London of the British Industrial Measuring and Control Apparatus Manufacturers' Association, Mr. W. G. Ardley said that the status of the Association was higher now than it had ever been. The importance of industrial instrumentation and the vital part it had to play in the industrial recovery of the country was now fully recognised on all sides.

VICKERS-ARMSTRONGS, LIMITED, and Sulzer Bros. (London), Limited, announce that an agreement has been concluded between them under which Vickers-Armstrongs will manufacture Sulzer engines for locomotives and other rail-traction services at their Barrow-in-Furness Works. Under the agreement all questions of sales and co-ordination of design of the complete vehicles will be handled by Sulzer Bros.

THE DIRECTORS OF THE Midland Bright Drawn Steel & Engineering Company, Limited, propose to increase the authorised capital of the company to £200,000 by the creation of £100,000 new 5½ per cent. £1 cumulative preference shares, and 1,000,000 1s. ordinary shares. There are no definite proposals for the issue of any further capital at present, but the directors consider it desirable to have unissued shares available for issue in the future.

A CONTRACT FOR the widening and strengthening of the bridge carrying Rockingham Road over the main Kettering to Nottingham line at Corby, Northants, has been placed with the Butterley Company, Limited. The work, which will complete a major road-widening scheme eliminating a bottleneck outside the works of Stewarts and Lloyds, Limited, involves the widening of the railway bridge from 25 ft. to 60 ft. in order to accommodate a 30-ft. roadway and two 15-ft. footpaths.

VULCAN FOUNDRY, LIMITED, locomotive builders and ironfounders, of Newton-le-Willows, which has since 1943 held an interest in Robert Stephenson & Hawthorns, Limited, locomotive builders and non-ferrous founders, of Darlington and Newcastle-upon-Tyne, announces that its stock holding now exceeds one-half of that company's equity capital, thus constituting Robert Stephenson & Hawthorns a subsidiary company of Vulcan Foundry within the meaning of Section 127 of the Companies Act, 1929.

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clean iron, free from sand, free from sows ...uniform analysis... convenient size...easy handling... specify STANTON MACHINE CAST PIG IRON

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WEIGHT	80-90 lbs.
Length	22 inches
Width	8½ inches
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THE STANTON IRONWORKS COMPANY LIMITED NEAR NOTTINGHAM

New Companies

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

White, Clark, Hyam & Company, 4a, Charles Street, Hull—Electric welders. £2,000. D. G. White, T. A. Clark, J. W. Hyam, and K. Smith.

A. E. Turner & John Coates & Company, Victoria House, Melbourne Place, Strand, London, W.C.2—Engineers. £5,000. A. E. Turner.

George Bagnall & Company, 37, Victoria Street, Liverpool—Diecasters, patternmakers, etc. £7,000. G. E. Bagnall, H. and S. Cheetham.

Lewkin Engineering, Anglo Trading Estate, Shepton Mallet, Som—£5,000. A. R. A. Lewis, W. H. King, A. C. Griffiths, and G. A. P. Matty.

Walter W. Hosken, 24, Crimscott Street, Bermondsey, London, S.E.1—Ironfounders, £5,000. W. J. R. and C. Bullers, and W. H. Gildersleeves.

Essex Die-Casting & Engineering Company, Richmond Works, West Road, Shoeburyness, Essex—£5,000. J. Ferguson, H. Drew, and A. Clarke.

B. Saxton & Company, Barnfield Mill, Arley Street, Hyde, Ches—Sheet-metal workers and general engineers. £15,000. B. and B. B. Saxton.

Hayward Turbine Engineering Company (1947)—£20,000. I. J. Carvalho, Cherry Tree Farm, Great Kingshill, High Wycombe, subscriber.

W. Shaw & Company, Wellington Cast Steel Foundry, Middlesbrough—Steel foundrymen and engineers. £300,000. H. A., W. G., and G. Shaw.

Vibration Engineering Company, Stanley Works, Kempston, Hardwicke, Beds—£10,000. S. Ibbett, G. Kopp, F. G. Strong, and H. H. Harper.

A. J. Rooke & Son, 219, Montague Road, Edmonton, London, N.18—Scrap-iron and metal merchants. £1,000. H. Green, A. J. and F. W. Rooke.

Hughes (Low Moor), Low Moor Trading Estate, Low Moor, Bradford—Mechanical and general engineers, etc. £10,000. G. and C. A. Hughes.

Sismey & Linforth, 241, Alcester Road South, Birmingham—Furnace builders and engineers, etc. £7,000. D. and J. E. Sismey, and F. C. A. Linforth.

Cold Rolling Mills, 43/9, Lime Street, Newcastle-upon-Tyne—£20,000. G. A. Marsden, F. G. and F. G. Henderson, jnr., W. Matthewson, and R. M. Graham.

J. C. Broadhead, 407, Temple Chambers, 33, Brazennose Street, Manchester, 2—Manufacturers of machinery, plant, etc. £5,000. J. C. and N. Broadhead.

Dixon's Ironworks, 1, Dixon Street, Glasgow—To acquire the business of ironmasters, etc., carried on at Govan Ironworks, Glasgow, by William Dixon, Limited. £250,000. D. B. Warren, J. M. Thomson, P. M. and T. Ritchie, and A. S. MacLellan.

Obituary

MR. GEORGE RUSTON SHARPLEY died on January 11 at the age of 76. He was chairman of Ruston & Hornsby, Limited, engineers and boilermakers, etc., of Lincoln, and Davey, Paxman & Company, Limited, engineers and ironfounders, etc., of Colchester. He was also vice-chairman of Ruston-Bucyrus, Limited, excavating-machinery manufacturers, of Lincoln, and a director of Ransomes, Sims & Jeffries, Limited, engineers and ironfounders, of Ipswich, and Ruston & Hornsby Australia (Proprietary), Limited. A nephew of the founder of Ruston & Hornsby, Limited (Mr. Joseph Ruston), Mr. Sharpley had been associated with the company for 60 years. He became an apprentice at Ruston's at the age of 16 and was appointed works manager when he was 23. In 1918, when Ruston's amalgamated with Richard Hornsby & Sons, Grantham, he became joint managing director and two years later was appointed sole managing director. Mr. Sharpley was appointed chairman of the company in 1938 and resigned from the managing directorship in 1943. He travelled extensively and in 1928 made a nine-month world tour to study market probabilities. His death occurred less than a fortnight after being taken ill on the eve of a business trip to America, Australia and New Zealand. Mr. Sharpley was responsible for the production of the earliest oil engines.

Death of Mr. H. H. Berresford

Mr. Harold Higginbottom Berresford died suddenly on Sunday night. Born in 1880, he entered the accountant's department of the Staveley Coal & Iron Company, Limited, in 1898 and qualified by examination for the Chartered Institute of Secretaries. Mr. Berresford held the positions of cashier, registrar, assistant secretary, assistant general manager, commercial manager, deputy managing director, and managing director of the company.

He was also a director of a number of other companies, including Bradley & Foster, Limited, manufacturers of refined irons, alloy castings, etc., of Darlaston, Staffs, Doncaster Amalgamated Collieries, Limited, British Soda Company, Rea, Limited, National Benzole Company, Limited, and Clayton Aniline Company.

Mr. Berresford was the first president of the Joint Iron Council, a position he continued to hold. He was a Regional Controller of the Ministry of Production in 1942-43. He was made a Justice of the Peace in 1932.

The sympathy of his many friends in the foundry industry will be extended to his widow, two sons and daughter.

HORTIN & FORRESTER, LIMITED, iron and steel merchants, of Wirral, Cheshire, is being wound up voluntarily. Mr. K. G. Lyon, 19, Castle Street, Liverpool, is the liquidator.

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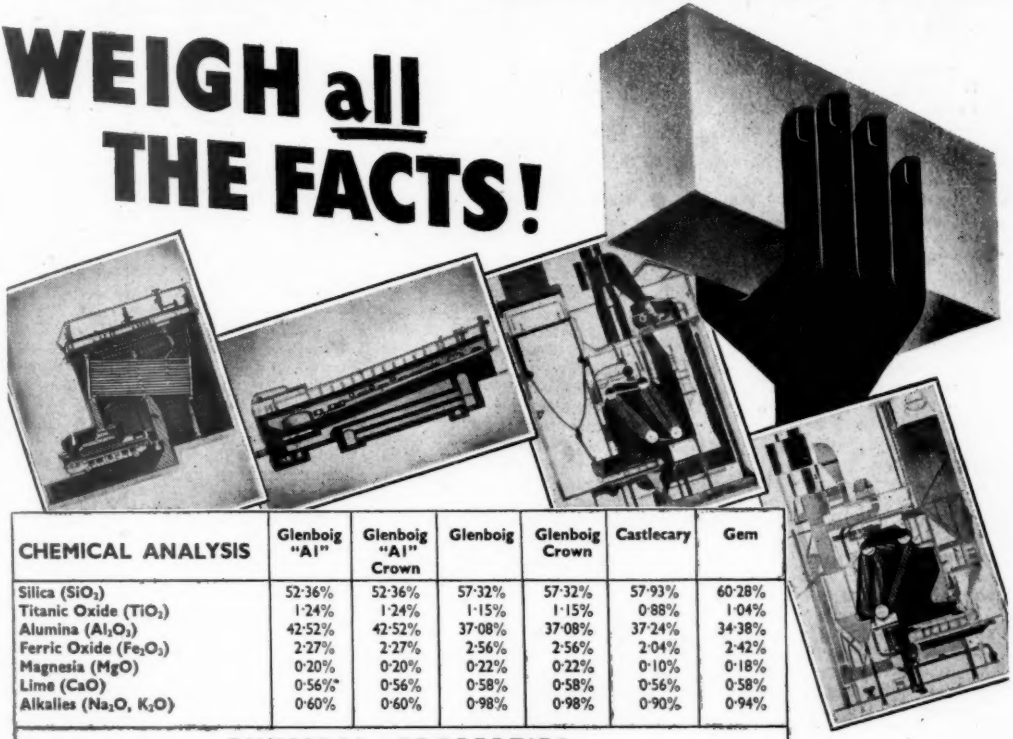

CHEMICAL ANALYSIS	Glenboig "AI"	Glenboig "AI" Crown	Glenboig	Glenboig Crown	Castlecary	Gem
Silica (SiO_2)	52·36%	52·36%	57·32%	57·32%	57·93%	60·28%
Titanic Oxide (TiO_2)	1·24%	1·24%	1·15%	1·15%	0·88%	1·04%
Alumina (Al_2O_3)	42·52%	42·52%	37·08%	37·08%	37·24%	34·38%
Ferric Oxide (Fe_2O_3)	2·27%	2·27%	2·56%	2·56%	2·04%	2·42%
Magnesia (MgO)	0·20%	0·20%	0·22%	0·22%	0·10%	0·18%
Lime (CaO)	0·56%	0·56%	0·58%	0·58%	0·56%	0·58%
Alkalies (Na_2O, K_2O)	0·60%	0·60%	0·98%	0·98%	0·90%	0·94%

PHYSICAL PROPERTIES						
Refractoriness	Seger Cone 34 (1750°C)	Seger Cone 34 (1750°C)	Seger Cone 32/33 (1720°C)	Seger Cone 32/33 (1720°C)	Seger Cone 32/33 (1720°C)	Seger Cone 31/32 (1700°C)
Refractoriness U/L of 2 kilos/sq. cm.	1630°C	1610°C	1610°C	1580°C	1600°C	1580°C
Refractoriness U/L of 50 lb./sq. in.	1580°C	1530°C	1530°C	1510°C	1520°C	1510°C
Thermal (Reversible) Expansion—mean co-efficient X 10^{-5}	0.568	0.522	0.584	0.540	0.562	0.623
Porosity—Total Percentage by Volume	18/20	24/26	18/20	24/25	16/20	16/20

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Raw Material Markets

Iron and Steel

The recently-erected large-capacity blast furnace at the Clyde ironworks was put into production last week; it will help to ease the difficulties of the steelmakers in that area. But there are still deficiencies in the production of basic iron elsewhere, and it is indicated that the needs of the steel plants must receive attention before there can be any expansion in the production of pig-iron for foundry purposes. The scarcity of high-phosphorus iron is most pronounced and efforts to mitigate the difficulty by the use of larger tonnages of cast-iron scrap have met with little success owing to the shortage of this material. Nor are deliveries of low-phosphorus, refined and hematite iron wholly satisfactory, and hand-to-mouth working is the rule rather than the exception in the foundry trade.

An overwhelming demand for re-rolled products offers extensive scope for the expansion of production, but the lack of adequate supplies of billets, blooms, and sheet bars is a limiting factor. The urgency of the need for small billets is indicated by the avidity with which re-rollers seize upon any defectives which the steelmakers have to offer. Even these, however, are scarce and the volume of imports is also very restricted. Sheet makers are still fairly well placed for slabs, but are pressing for more liberal supplies of bars. Of the urgency of the need for sheet bars there can be no question, but home producers are already providing maximum tonnages and the only hope of an improvement seems to depend on the success of the continuing efforts to secure more material from the United States or the Continent.

There is still no increase of any kind in finished-steel prices to offset the rise of 2s. 6d. per ton in the price of coal which became operative on January 1. If there is no adjustment, this will constitute a heavy burden on the steel industry which is making a substantial contribution to the nation's economic recovery. A good deal of interest is centred on the new regulations governing the distribution of iron and steel and, apart from the new departmental symbols, it is noted with satisfaction that orders for steel for any one quarter will cease to be valid after the end of that particular period. By this means it is hoped to eliminate the heavy backlogs which have been a source of embarrassment to producers. Large tonnages, far in excess of capacity, are at present on order and it will be an advantage if rolling programmes can be arranged so as to concentrate on the more essential needs. Sheets, plates, and sections are heavily specified, railway equipment for home use is rationed, and colliery requirements are so heavy that difficulties have been experienced in placing orders for the fully-authorised quotas.

Non-ferrous Metals

The tone of the non-ferrous metal markets on both sides of the Atlantic continues to strengthen, and there is now a fairly definite belief that the persistent bidding by consumers in Europe will compel an upward revision of America's selling prices. The public in the United States is being well warned by the President that the eventual outcome of the present inflationary madness must be a severe slump in trade, but his words do not seem to have a great deal of effect. Here in Britain the Government continues to exhort the population to greater productive efforts, while warning them that in the near future further cuts may be necessary. The metal trade, or one section of it at least, has always pointed out that the London futures market provided invisible exports when it was allowed to function, and could do the same thing again to-morrow. How long will it be before the Cabinet adopts this view?

Although figures are not yet forthcoming, it seems not unlikely that consumption of non-ferrous metals has not so far this year been quite on the scale seen in October and November. December will probably be seen to have fallen below the other months owing to the Christmas break. Whether, indeed, 1948 is going to register a recession in non-ferrous activity in comparison with last year, it is too early as yet to say, but signs are not wanting, and informed opinion rather takes the view that some scaling down of activity is on the way. This may not prove to be such a bad thing in view of the difficulty we shall experience in securing all the raw material required to cover the needs of the trade. As to that, the Ministry of Supply is, as usual, keeping its own counsel, but it is reasonably certain that a start has been made on the provisioning of copper for the second half of this year, and it is also reported that the Government has been buying zinc for delivery this half.

Price of Straits Tin

Following a meeting last week between representatives of the Ministry of Supply, the Colonial Office and the Malayan Chamber of Mines, a joint statement was issued in which it was stated that the departments concerned and the Chamber much regret that, owing to a series of misunderstandings, inaccurate accounts have received currency of the circumstances in which the price of Straits tin was recently raised from £423 to £500 per ton, and in which this decision was communicated to the Governor of the Malayan Union.

At a meeting held on December 11, the Chamber, after considerable discussion, was informed that H.M. Government was not in a position to offer a price of more than £500, and the Chamber replied that it was not in a position to accept this price. The attitude of the Chamber was duly reported to the Governor of the Malayan Union by the Secretary of State for the Colonies. H.M. Government considered that no useful purpose would be served by further delaying the increase in the price, and the new price accordingly became effective on December 19. In conclusion, the statement pointed out that the whole question of tin prices, including the protection of the premium on Straits tin, was discussed and will form the subject of a further meeting.